CLAIMS

1. A packet router comprising an input stage, an output stage and a coupling stage for coupling the input and output stages,

the input stage having plural input devices each for receiving packets having packet data comprising packet destination data, each input device having at least one output element;

the output stage having plural output devices defining plural router output nodes, each output device having at least one input element;

the coupling stage providing paths for signals between said output elements of the input devices and said input elements of the output devices;

wherein each input device has circuitry arranged to respond to packet destination data of a packet received by said input device for adding, to the packet data of the packet, information indicative of a router output node at which the packet is to be output;

wherein the router further comprises a control device connected to said input stage and to said coupling stage for causing packets to be output to said coupling stage in dependence on said information;

wherein each output device has circuitry for removing said information prior to output of packets; and

wherein the router further comprises a connecting device arranged to receive said signals from paths of the coupling stage and to transfer said signals to a further said output device disposed remote from said input stage.

2. A packet router according to Claim 1, wherein each said input device has a plurality of inputs, a plurality of output elements, and comprises a respective memory arranged to receive data from all of the said plurality of inputs and arranged to output data to all of

said plurality of output elements; and wherein each output device has a plurality of input elements and a plurality of router output nodes, and comprises a respective memory arranged to receive data from all of the said plurality of input elements and arranged to output data to all of said plurality of output nodes.

3. A packet router according to Claim 1 or 2, wherein said coupling stage is arranged to vary the paths between the input stage and the output stage, and said control device is arranged to cause packets to issue from the input stage when a desired path is provided.

4. A packet router according to Claim 1 or 2, wherein said control device is arranged to control the coupling stage to set up a desired path from the input stage to the output stage and to cause packets to issue from the input stage for the desired path.

5. A packet router according to any preceding claim, wherein the coupling stage is arranged to provide at least one fixed path.

6. A packet router according to any preceding claim, wherein the input devices comprise segmenting circuitry arranged to divide received packets into segments of common length prior to application to said coupling stage, wherein each segment includes the said router output node information of the packet and the output devices comprise desegmenting circuitry arranged to assemble segments received from said coupling stage into packets.

7. A packet router according to any preceding claim, wherein the input devices have optical output elements and the output devices have optical input elements and the coupling stage is arranged to provide free-space optical paths between said optical output elements and optical input elements.

8. A packet router according to any preceding claim wherein the connecting device comprises a passive optical network.

9. A packet router according to Claim 7 or 8, wherein the input stage has a plurality of inputs capable of carrying a first plurality of packets to said router in a given time period, and the coupling stage is capable of providing said paths between said output elements of the input devices and said input elements of the output devices, wherein said paths are arranged to be able to carry more than said first plurality of packets in said given time.

10. A packet router according to Claim 9, wherein the number of spatially separate paths provided by said coupling stage is greater than the number of inputs to said input stage.

11. A network comprising a packet router according to any preceding claim wherein each input device comprises storage for holding queues of packet data prior to issue to said coupling stage, and each output device has storage for queues of packet data received from the coupling stage, and further comprising at least a second packet router, the said at least a second packet router having a second router input stage, a second router output stage and a second router coupling stage for coupling the second router input and output stages, wherein the second router input stage has plural input devices each for receiving packets having packet data comprising packet destination data, each second router input device having at least one output element and storage for holding queues of packet data prior to issue to said second router coupling stage, wherein the second router output stage has plural output devices defining plural output nodes, each output device having at least one input element, wherein the second router coupling stage is arranged to provide paths between said output elements of the

input devices and said input elements of the output devices, and wherein at least one of the input devices of the second router input stage is provided by said further said output device of said packet router disposed remote from said input stage of said first packet router, wherein each queue of packet data received from the coupling stage of the first packet router forms a queue of packet data for issue to the coupling stage of the second router.

12. A network comprising a first and at least one second packet router, each packet router comprising an input stage having plural input devices, an output stage having plural output devices and a coupling stage for providing paths between said input devices and said output devices; each input device having storage for holding queues of packet data prior to issue to said coupling stage, each output device having storage for queues of packet data received from the coupling stage;

wherein at least one of the input devices of the second packet router is provided by an output device of said first packet router such that each said queue of packet data received from the coupling stage of the first packet router forms a queue of packet data prior to issue to said coupling stage of said second router.

13. A network according to Claim 12, wherein each said input device has a plurality of inputs and a plurality of output elements and a respective memory providing said storage for holding queues of packet data prior to issue to said coupling stage arranged to receive data from all of the said plurality of inputs and arranged to output data to all of said plurality of output elements, and wherein each output device has a plurality of input elements and a plurality of router output nodes and a respective memory providing said storage for queues of packet data received from the coupling stage and arranged to receive data from all of the said plurality of input elements and arranged to output data to all of said plurality of output nodes.

14. A network according to Claim 12 or 13, wherein each packet router has a respective control device connected to its input stage and to its coupling stage for outputting packets to said coupling stage in dependence on routing information carried by packets.

15. A network according to Claim 14, further comprising a management device connected to receive information on the size of queues in each said output device.

16. A network according to Claim 15 wherein the management device is connected to each control device for modifying routing tables in accordance with said queue size information.

17. A network according to any of Claims 12-16, having means for discarding packets in said output stages if queues therein overflow.

18. A network according to any of Claims 12-17 wherein the coupling stage of at least the first packet router is arranged to optically couple the input stage of the first packet router to the output stage of the first router.

19. A network according to Claim 18, wherein the said coupling stage is arranged to provide free-space connections.

20. A method of routing packets using a packet router comprising an input stage, plural output devices and a coupling stage for coupling the input stage and output devices, wherein at least one of the output devices is spatially remote from the coupling stage;

the method comprising:-

in said input stage, examining packet destination data of a packet received by said input stage and in response thereto

adding, to the packet, router information indicative of a router output node of said at least one of said output devices, at which the packet is to be output to provide enhanced packet data;

in dependence on said router information, determining whether a path is available from an input of said coupling stage to an output connected to said at least one output device;

outputting said enhanced packet data to said input of said coupling stage, whereby the enhanced packet data is carried to an output of said coupling stage for said at least one output device having the said router node;

receiving the enhanced packet data from said coupling stage output and transferring the packet data over a link to said at least one output device;

receiving said enhanced packet data in the said output device;

removing said router information; and

outputting said packet at said router output node.

21. A method of routing packets using a router comprising an input stage having plural output elements, plural output devices each having plural input elements, the plural output devices each having a plurality of output nodes, said output nodes together defining the output nodes of said router, and a coupling stage for coupling the plural output elements of the input stage to plural coupling stage outputs, wherein at least one output device is spatially remote from the coupling stage and the router further comprises a link between predetermined outputs of said coupling stage and the plural inputs of said at least one output device;

the method comprising:-

receiving respective packets at each of plural inputs of said input stage;

in response to packet destination data of said packets, adding to each packet respective router node information indicative of a router output node at which the said packet is to be output, thereby to form enhanced packet data comprising said packet data and said router node information;

storing said enhanced packet data for each packet in a common input memory;

in dependence on said router node information indicative of an output node in said at least one output device, determining an available path through said coupling stage from an output element of said input stage to one of said predetermined outputs of said coupling stage;

outputting said enhanced packet data from said common input memory to said output element, whereby the enhanced packet data is carried to one of said predetermined outputs of said coupling stage;

transferring the enhanced packet data over said link to one of said plural inputs of said at least one output device;

receiving said enhanced packet data at the said output device;

removing said router node information indicative of said output node to form packet data;

storing said packet data in a memory common to the input elements of said output device and to the output nodes of said output device; and

outputting a packet at said router output node from said memory.

22. A method according to Claim 20 or 21, comprising varying paths provided by said coupling stage between the input stage and the output stage, and causing packets to issue from the input stage when a desired path is provided.

23. A method according to Claim 22, wherein said varying step comprises providing a sequence of path combinations, and selecting between said path combinations on a timed basis.

24. A method according to Claim 22, wherein said varying step comprises providing a set of path combinations, and selecting between the members of said set in accordance with a statistical analysis of traffic in said router.

25. A method according to Claim 22, comprising controlling the coupling stage to set up a desired path from the input stage to the output stage and issuing packets from the input stage to the desired path.

26. A method according to Claim 22, wherein the coupling stage is arranged to provide at least one fixed path.

27. A method according to any of Claims 22-26, comprising dividing received packets into segments of common length prior to application to said coupling stage, and adding the said router node information to each segment.

28. A method according to any of Claims 22-27, comprising coupling between the input stage and the output devices using free-space optical paths.

29. A method according to Claim 28, wherein transferring step is carried out using a passive optical network.

30. A method according to any of Claims 22-29, comprising carrying data across said coupling stage faster than said data is received at said input stage.

31. A method according to any of Claims 22-30, comprising providing a number of spatially separate paths in said coupling stage wherein said number is greater than a number of inputs to said input stage.

32. A method according to any of Claims 22-31, comprising:

holding queues of enhanced packet data prior to issue to said coupling stage,

holding queues of packet data received from the coupling stage,

locating at least one of said queues of packet data received from the coupling stage at an input of a second router having a second router coupling stage, said second router holding queues of packet data prior to issue to said second router coupling stage, and using said at least one of said queues as a said queue of packet data prior to issue to said second router coupling stage.

33. A method according to any of Claims 22-32, comprising providing information on the size of queues of data received from said coupling stage, and using said information to effect changes on routing information.